

2009 APPLICATION FORM

(required for each entry)

Complete this section for (check one): ☐ **Small Project** ☒ **Large Project**
☐ **Post-Design Solution** ☐ **Off System Project**

Job No. J4I1507 Route I29/I35 County / LPA Jackson/Clay

Description (attach separate sheet if necessary) See Attached Sheet

Complete this section for: **Process Improvement**

Process or Product _____

Description (attach separate sheet if necessary) _____

Project Leader Bryan Wilkerson - PCC

Key Team Members (include key personnel irrespective of employer-nine individuals maximum)

Todd Owens - PCC Thad Kosmicki - PCC Tom Skinner - MoDOT

Bob Arends - PCC Dave Glastetter - PCC Steve Levorson - PCC

Liz Smith - PCC Mark Hartegan - PCC Kevin Irving - FHWA

Project Budget:

Initial Cost / Estimate \$ 1,800,000 Final Cost / Award \$ 425,000

What would make this entry stand out from the rest of the entries when considering MoDOT's practical design philosophy? (In layman's terms - 200 words or fewer-attach separate sheet if necessary) _____

See Attached Sheet

Send entries to: MoDOT Design Division, ATTN: Joe Jones
1320 Creek Trail Dr., Jefferson City, Missouri 65109

ALL ENTRIES MUST BE RECEIVED NO LATER THAN CLOSE OF BUSINESS ON DECEMBER 1, 2008

Description

Located in Kansas City, the \$245 million kcICON design build project will reconstruct approximately 4 miles of Interstate I-29/I-35 and five interchanges. The scope of work also includes the reconstruction, rehabilitation, or replacement of twelve bridge structures, including the new cable stay Christopher S. Bond Bridge over the Missouri River. The design build, fixed price contract offered an unprecedented opportunity to develop innovative design solutions and cutting edge technology to provide the best value for every dollar spent on the project.

MoDOT's Practical Design Philosophy

When the kcICON project initiated design of the bridge foundations, 20" diameter friction pipe piles (1/2" thick wall thickness) were proposed for the foundations at six bridges. The quoted cost for the steel pipe piles was \$120 per linear foot for fabrication and delivery in four months. The historical increase in the cost of structural steel, compromised the project budget as well as the fast track design build construction schedule. MoDOT has not used prestressed concrete piling for bridge foundations in more than 30 years. Using the latitude and flexibility offered by the kcICON design build contract, the design team resurrected the use of prestressed concrete piling for bridge foundations. The concrete piling proved to be a budget saving and schedule friendly alternative for steel pipe piles. 14" square, prestressed concrete piles cost \$34 per linear foot and could be fabricated and delivered in only three weeks resulting in an estimated project savings of \$1,375,000. A Standard Specification and a Standard Plan Sheet was developed for the project in such a manner that this practical design solution can be used on nearly every future bridge project resulting in long term savings for MoDOT.

November 30, 2008

Mr. Joe Jones, P.E.
Engineering Policy Administrator
105 West Capital
Jefferson City, Missouri 65102

RE: Practical Design – 2009 Awards for Excellence
Resurrection of Precast, Prestressed Concrete Piles for Bridge Foundations

General: Located in Kansas City, the \$245 million kcICON design build project involves the reconstruction of approximately 4 miles of Interstate I-29/I-35 and five interchanges. The scope of work also includes the reconstruction, rehabilitation, or replacement of twelve bridge structures, including the new cable stay Christopher S. Bond Bridge over the Missouri River. The contract was awarded to Paseo Corridor Constructors (PCC) in November 2007 and design will be completed in December 2008. Construction will be completed by July 2011. The design build, fixed price contract offered an unprecedented opportunity to develop innovative design solutions and cutting edge technology to provide the best value for every dollar spent on the project. This became very clear early in the project when the price of structural steel nearly doubled in a matter of nine months. The historical increase in the price of structural steel posed a serious financial threat to the project budget as well as the ability to complete the project on schedule.

The Practical Design Plan: On the kcICON project, there are six bridge structures that will be founded on friction piles due to the sand and gravel geologic profile and the extreme depth to sound bedrock. For more than three decades, MoDOT has generally used steel pipe piles or steel H piles as friction piles for bridge foundations. The reasonable cost of the steel piling and the ease of fabricating, furnishing and driving the steel piles made them the preferred choice for bridge foundations. Two years ago, pipe piling (used as friction piles) for bridge foundations cost approximately \$40 per foot for 20" diameter steel pipe piles, fabricated and furnished to the project site. When the kcICON project initiated design of the bridge foundations, 20" diameter friction pipe piles (1/2" thick wall thickness) were proposed for the friction pile foundations at six bridges. When the initial order was placed, the contractor was quoted a four month delivery date and a price of \$120 per linear foot just to have the pipe piles fabricated and delivered to the project site. This historical increase in the cost of the pipe piles and the long lead-time in delivery presented a substantial threat to the project budget as well as the project schedule.

A cost effective and timely alternative bridge foundation to the steel pile foundations had to be identified. Alternative foundations were evaluated including spread footings, auger cast-in-place piles, micropiles, and prestressed concrete piles. Early in the evaluation process, it was noted that 14" square, prestressed concrete piles would cost only \$34 per linear foot, fabricated and delivered to the project site. In addition, from the time of placing the order to the time of delivery was only three weeks in lieu of four months for

the steel piles. After careful consideration and thoughtful review of the site geology, foundation criteria and the required design bearing capacity at each bridge site, 14" square precast, prestressed concrete friction piles were selected for the bridge foundations at six of the bridge structures. Equally important to note is that the concrete piles were shorter than the steel pipe piles and yet provided the same bearing capacity.

Since MoDOT does not currently have a Standard Specification or a Standard Plan Sheet for prestressed concrete piling. In addition, MoDOT has not used prestressed concrete piling in bridge foundations for over 30 years. Therefore, once the decision was made to use prestressed concrete piles, attention quickly focused on the development of the material and construction specifications for this cost effective and time saving practical design solution. Using the material specifications and standard plans for concrete piles that were available from other State Departments of Transportation, the design build team collated the best material specifications and design features from several sources and prepared a material specification and a standard plan for the project specific prestressed concrete piles. It is important to note that, the concrete piling details and standard plans were prepared in such a manner, that MoDOT could include the prestressed concrete piles in their Standard Plans and Specifications, just by issuing the project details as an addendum to the Standard Specifications without substantial changes.

The prestressed concrete piles were initially chosen because their cost was about one quarter the cost of the steel pipe piles, resulting in a substantial project savings, which kept the project on budget. However, the concrete piles also provided an additional benefit of timely fabrication and delivery, which preserved the project schedule. Typically steel piles require four months for fabrication and delivery to the project site. The concrete piles were cast locally (within 10 miles of the project site) and could be delivered to the project site within three weeks of placing the order. This enhanced fabrication and delivery schedule has been a crucial benefit for the project and has provided more flexibility in the construction schedule and greatly preserved the design build fast track project schedule.

In short, the rebirth in the use of prestressed concrete piling for bridge foundations has proven to be a cost effective bridge foundation, which is schedule friendly and can be applicable to nearly every new MoDOT bridge project.

ROUTE	STATE	DISTRICT
1-29	MO	4
JOB NO.	441507	
COUNTY	JACKSON-CLAY	

SPECIFICATIONS: SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION AS CURRENTLY USED BY THE KANSAS DEPARTMENT OF TRANSPORTATION. THE FOLLOWING ITEMS ARE COVERED IN DIVISIONS 400, 700 & 1600 OF THE STANDARD SPECIFICATIONS:

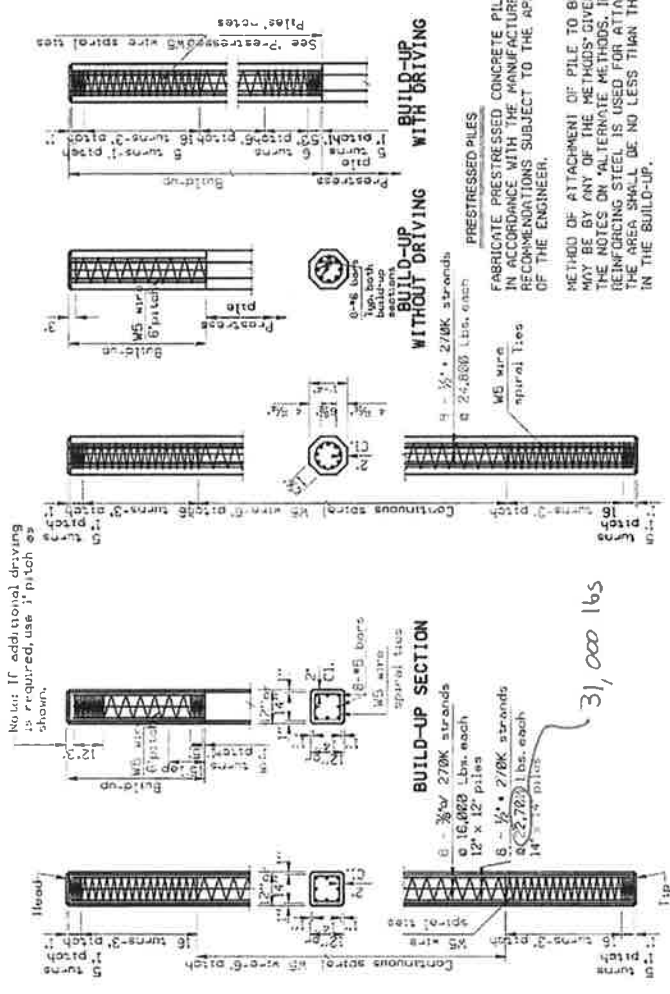
CONCRETE: FOR PRESTRESSED PILES SHALL BE 7'000 PSI.

TEST PILES: TEST PILES WHERE CALLED FOR ON THE BRIDGE PLANS. THE TEST PILES LOCATED WITHIN THE LIMITS OF THE SUBSTRUCTURE WILL BECOME A PART OF THE BRIDGE PILE SYSTEM.

DRIVING FORMULA: SHALL CONFORM TO THE STANDARD SPECIFICATIONS.

REINFORCEMENT: REINFORCING STEEL CONFORMING TO ASTM A615, GRADE 60. WELDED JOINTS SHALL BE USED ONLY WHEN NECESSARY.

PRESTRESSING: STEEL-WIRE STRESS RELIEVED OR LOW RELAXATION PRESTRESSING STRAND CONFORMING TO ASTM A416, GR. 270.



16" PRESTRESSED CONCRETE PILES

12" OR 14" PRESTRESSED CONCRETE PILES

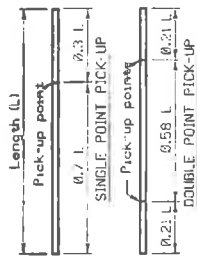
ALTERNATE METHODS:

METHOD OF ATTACHMENT OF A PILE TO BUILD-UP MAY BE BY ANY OF THE FOLLOWING METHODS:

1. CUT OFF AT LEAST 2'-0" OF PILE AND EXPOSE A MINIMUM OF 2'-0" OF STRANDS.
2. CAST 8" x 8" OR 8" x 16" BARS (EQUALLY SPACED) INTO PILE HEAD AND PROJECT FROM THE PILE HEAD A MINIMUM OF 2'-0".
3. DRILL 8 HOLES IN PILE HEAD (EQUALLY SPACED) FOR INSTALLATION OF 8 GROUTED DOMEL BARS OF SAME SIZE AND LENGTH AS IN 2.
4. PROVIDE CORED HOLES FOR BARS AS IN 3.

NO BARS OR STRANDS ARE TO EXTEND FROM HEAD OF PILE OR BUILT-UP OR TO FOOTING OR PILE CAP UNLESS APPROVED BY THE ENGINEER.

FOR INFORMATION ONLY			
EQUIVALENT	STEEL	CONCRETE	PILES
	PIPE	PIPE	PRE-STRESS
	HPIB-42	10	10
	HPIB-53	12	12
	HPIB-63	14	14
	HPIB-73	16	16



PICK-UP POINTS FOR PRESTRESSED PILING

MAX. LENGTH - 55' SINGLE POINT PICK-UP

MAX. LENGTH - 80' DOUBLE POINT PICK-UP

NOTE: PILES SHALL BE MARKED AT PICK-UP POINTS TO INDICATE PROPER POINTS FOR ATTACHING HANDLING LINES.

PRELIMINARY

NOT FOR CONSTRUCTION

DESIGNED BY: MS	CHECKED BY: RLA
DRAWN BY: AJD	
DATE: 06/05/08	

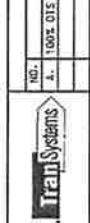
THE KCI CON PROJECT

SOUTHBOUND I-29/35 OVER 16TH AVE

STANDARD PILE DETAILS



NO.	DESCRIPTION	DATE
1.	100% QIS REVIEW	06/05/08



CONSTRUCTORS

DRAWING NUMBER

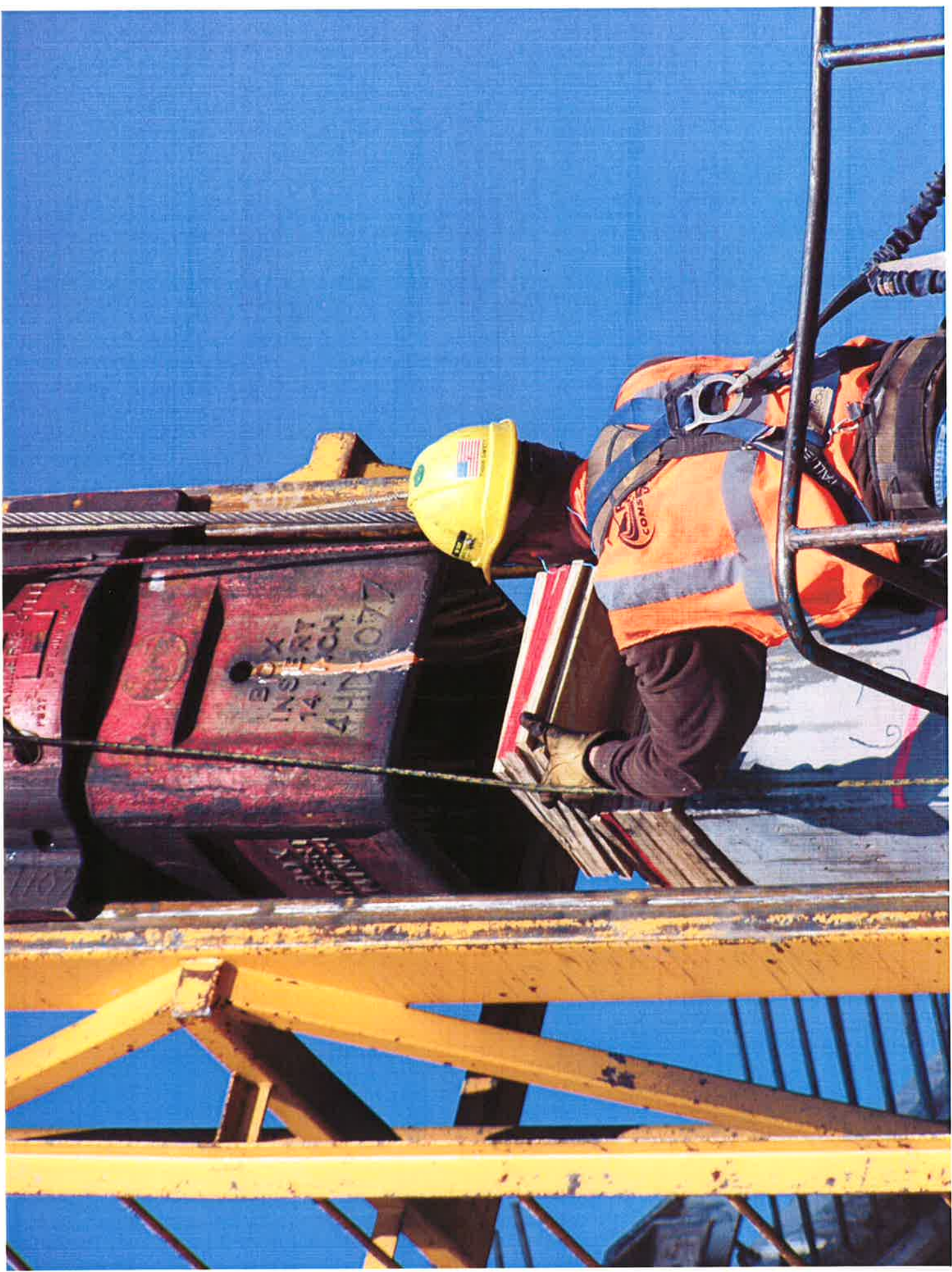
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Lifting the Concrete Pile



Aligning the pile in the leads



Placing the pile cushions



Driving the Pile



Cutting the piles to Elevation



Completed Pile Pattern